Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Solve each problem neatly, either directly on the quiz or on a separate sheet of paper. Be sure to clearly circle the letter of the answer you have selected for each problem. Write the answer to Question #35 directly on this test paper.

**CLE 3126.1.1 Use mathematical language, symbols, definitions, proofs and counterexamples correctly and precisely in mathematical reasoning.**

3126.1.6 Understand the different representations of a function; discuss the criteria (such as the type of function and the problem under consideration) for determining which representation is most helpful.

1. Describe how to use the **vertical line test** to determine whether a relation is a function.
   1. If every vertical line drawn on the graph of a relation passes through no more than one point of the graph, then the relation is a function.
   2. If a vertical line passes through any point of the graph, then the relation is a function.
   3. If a vertical line passes through at least two points on the graph of a relation, then the relation is a function.
   4. None of the above
2. Which of the following graph(s) represent a **function**?
3. 
4. 
5. 
6. All of the above

Questions 3 and 4 pertain to the following graphed relation:



1. What is the **domain** of the graphed relation shown above?
   1. x = {-2, -1, 1, 2, 3}
   2. x = {-3. -2. -1. 0, 1}
   3. y = {-3. -2. -1. 0, 1}
   4. None of the above
2. What is the **range** of the graphed relation shown above?
   1. x = {-2, -1, 1, 2, 3}
   2. y = {-2, -1, 1, 2, 3}
   3. x = {-3. -2. -1. 0, 1}
   4. y = {-3. -2. -1. 0, 1}

3126.3.13 Visually locate critical points on the graphs of polynomial functions and determine if each critical point is a minimum, a maximum, or point of inflection.

1. Determine if the following function is continuous at the point x = 1.
   1. Yes, the function f(x) is continuous at x = 1.
   2. No, the function f(x) is not continuous at x = 1. \*
2. Consider the function

The point x=1 is a critical point for this function. Determine whether this critical point is the location of a maximum, minimum, or a point of inflection.

* 1. x = 1 is a maximum of f(x) \*
  2. x = 1 is a minimum of f(x)
  3. x = 1 is a point of inflection of f(x)
  4. None of the above

**CLE 3126.3.1 Develop an understanding of functions as elements that can be operated upon to get new functions: addition, subtraction, multiplication, division, and composition of functions.**

1. Given functions f(x) and g(x), find the **new function** obtained by **multiplying** the two functions. In other words, find the new function (f \* g)(x).

f(x) = 2x-1

g(x) = x2

1. (f \* g)(x) =
2. (f \* g)(x) =
3. (f \* g)(x) = \*
4. None of the above

1. Given functions f(x) and g(x), find the **new function** obtained by **subtracting** g(x) from f(x).

f(x) = x-5

g(x) =

1. (f - g)(x) = \*
2. (f - g)(x) =
3. (f - g)(x) =
4. None of the above
5. Given the functions f(x) and g(x), perform the requested **composition** of functions.

f(x) =

g(x) =

1. [f ° g](x) =
2. [f ° g](x) = \*
3. [f ° g](x) =
4. None of the above

3126.3.1 Calculate the inverse of a function with respect to each of the functional operations; in other words, the additive inverse, the multiplicative inverse, and the inverse with respect to composition.

1. What is the equation for the inverse of f(x) = x2 + 3?
   1. \*
   2. None of the above

**CLE 3126.1.4 Move flexibly between multiple representations (contextual, physical, written, verbal, iconic/pictorial, graphical, tabular, and symbolic), to solve problems, to model mathematical ideas, and to communicate solution strategies.**

3126.1.8 Draw qualitative graphs (sketches) of functions (linear, quadratic, cubic, square root, absolute value, reciprocal, trigonometric, exponential, logarithmic, and greatest integer) and describe their general shape/trend.

1. The equation of a line is given by 3x + 4y = 8. What are the **slope** and **y-intercept** of this line?
   1. Slope = 3/4 y-intercept = 2
   2. Slope = -3/4 y-intercept = 2 \*
   3. Slope = -3 y-intercept = 8
   4. None of the above
2. Which of the following pairs of lines are **perpendicular**?
3. y = 3x+2 and y = 3x – 2
4. y = 2x-4 and y = 3x+5
5. 3x – 2y = 5 and 2x+3y = 4 \*
6. None of the above
7. Graph
8. 
9. 
10. 
11. None of the above

**CLE 3126.3.2 Understand how the algebraic properties of an equation transform the geometric properties of its graph.**

3126.3.8 Given a function, describe the transformation of the graph resulting from the manipulation of the algebraic properties of the equation (i.e., translations, stretches, and changes in periodicity and amplitude)

1. Circle the letter of the answer that best describes how the graphs of f(x) and g(x) are related.
2. The graph of g(x) is the translation of the graph of f(x) **up** 6 units.
3. The graph of g(x) is the translation of the graph of f(x) **down** 6 units.
4. The graph of g(x) is the translation of the graph of f(x) **right** 6 units.
5. Circle the letter of the answer that best describes how the graphs of f(x) and g(x) are related.
6. The graph of g(x) is the translation of the graph of f(x) **reflected over the x-axis** and **expanded vertically** by a factor of 2.
7. The graph of g(x) is the translation of the graph of f(x) **reflected over the y-axis**.
8. The graph of g(x) is the translation of the graph of f(x) **expanded vertically** by a factor of 2.
9. Circle the letter of the answer that best describes how the graphs of f(x) and g(x) are related.
10. The graph of g(x) is the translation of the graph of f(x) **left** 4 units.
11. The graph of g(x) is the translation of the graph of f(x) **down** 4 units.
12. The graph of g(x) is the translation of the graph of f(x) **right** 4 units.
    * 1. Determine whether a function is even, odd, or neither
13. Determine whether the following function is even, odd, or neither: g(x) = -3|x|+4
    1. Even \*
    2. Odd
    3. Neither
14. Determine whether the following function is even, odd, or neither: f(x) = 2x-4
    1. Even
    2. Odd
    3. Neither \*
15. Determine whether the following function is even, odd, or neither:
    1. Even
    2. Odd \*
    3. Neither
16. Determine whether the following function is even, odd, or neither:

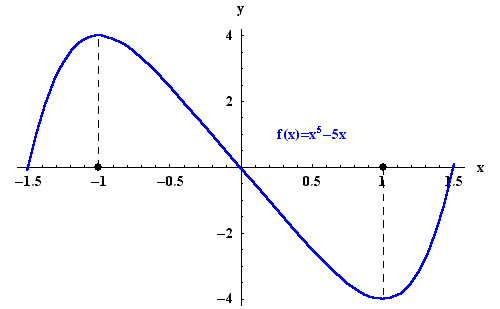


* 1. Even \*
  2. Odd
  3. Neither

**CLE 3126.3.4 Identify or analyze the distinguishing properties of exponential, polynomial, logarithmic, trigonometric, and rational functions from tables, graphs, and equations.**

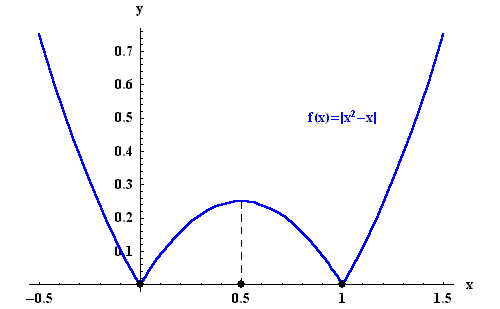
3126.3.14 For a given sketch of a graph of a function, describe the concavity and locate maximums, minimums, increasing and decreasing intervals, and zeroes.

1. On what interval(s) is the function shown below increasing? function



* 1. (-1.5 , -1) and (1 , 1.5) \*
  2. (-4 , 4)
  3. (-1 , 1)
  4. None of the above

1. Consider the following graph of the function f(x) = |x2 – x|. What points are the absolute minimum(s)?



* 1. (0, 0) and (0, 1)
  2. (0, 0) and (1, 0) \*
  3. 0 and 1
  4. None of the above

3126.3.9 Determine the asymptotes and end behaviors of functions

1. Describe the end behavior of
   1. As x 🡪 ∞, g(x) ≈
   2. As x 🡪 ∞, g(x) ≈ \*
   3. As x 🡪 ∞, g(x) ≈ - ∞
   4. None of the above

**CLE 3126.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including testing cases, estimation, and then checking induced errors and the reasonableness of the solution.**

3126.1.7 Analyze situations, develop mathematical models, or solve problems using linear equations or inequalities symbolically or graphically.

Questions 24 through 27 pertain to the following scenario:

You are thinking about starting a new part-time business detailing cars. For the following questions assume that **the variable x** represents the number of cars your business details each **month**. You plan to charge **$110** for each car that your business details. You will pay workers just for the number of cars that they work on. You will pay **$12/hour**, and it takes **2 people 2 hours** to detail each car. **$80** worth of cleaning supplies and air freshener would cover the detailing of **4 cars,** so that the cost of **cleaning suppliers per car is $20**. Your advertising costs are fixed at **$100 per month**.

1. Write an equation r(x) to describe the function of how much **revenue** your business will earn. Revenue is the total amount of money your company would earn for the services it sells.
   * 1. R(x) = 110
     2. R(x) = 110x \*
     3. R(x) = 110 + x
     4. None of the above
2. What would be the **labor costs per car**?
   * 1. L(x) = 48
     2. L(x) = 24x
     3. L(x) = 48x \*
     4. None of the above
3. Which of the following functions describes **all of the costs (including labor, supplies, and advertising)** of this business **per month**? Remember that any cost that depends on the number of cars detailed needs to be multiplied by x, the variable that represents the number of cars served in any month.
   * 1. C(x) = 48x+20x+100 \*
     2. C(x) = 24x + 120
     3. C(x) = 24x + 20x + 100
     4. None of the above
4. A profit function P(x) can be created by **subtracting** the **cost** function C(x) from the **revenue** function R(x). Which of the following functions represents the profit of this new business?
   1. P(x) = 42x-100 \*
   2. P(x) = 100 – 32x
   3. P(x) = 100x – 48x – 20x + 100
   4. None of the above
5. After you start a new business, you graph the profit that you earn each month. What has been the **average rate of change** in monthly profit between the **1st and 6th** months of operation?



Profit [$]

Month

* 1. $950
  2. $190/month \*
  3. $158/month
  4. None of the above

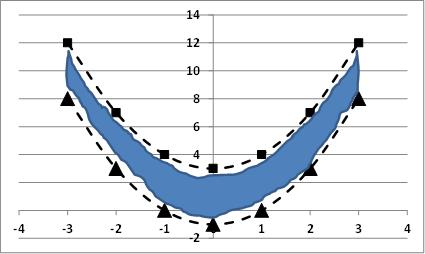
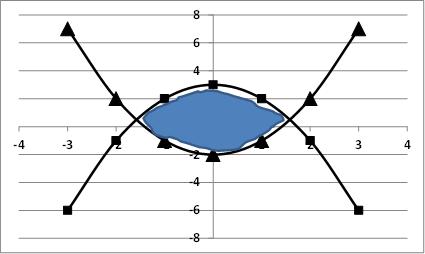
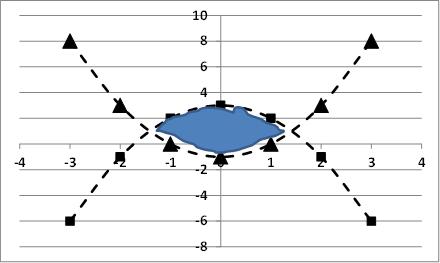
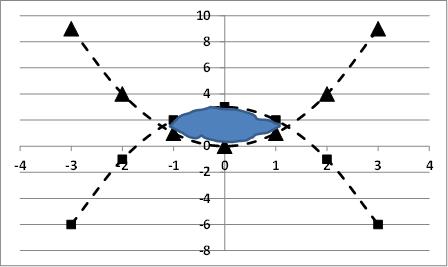
3126.1.10 Make inferences or predictions using an algebraic model of a situation.

1. Angela has been tracking the growth of new tree saplings in a protected section of Cheekwood Botanical Garden. The number of new trees has been growing at an average rate of 48 trees per year, and the garden currently has 294 young trees. If the number of tree saplings continues to increase at this same average rate, how many young trees should exist in the garden in 3 years?
   1. 144 trees
   2. 342 trees
   3. 438 trees \*
   4. None of the above

**CLE 3126.3.7 Solve nonlinear inequalities (quadratic, trigonometric, conic, exponential, and logarithmic).**

1. Solve
   1. -18 < x < 12 \*
   2. x < 12
   3. x > -12 and x < 12
   4. None of the above

3126.3.18 Solve systems of nonlinear inequalities by graphing**.**

1. Use graphing to identify the set of numbers that satisfy the following system of inequalities:
   1. ****
   2. ****
   3. ****
   4. ****

**CLE 3126.5.1 Create scatter plots, analyze patterns and describe relationships that exist in a set of linear and non-linear paired data to model real-world phenomena and make predictions.**

Questions 32 and 33 pertain to the table below which shows the weight of different cars and their average highway fuel economy.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Car weight [100 lbs] | 17 | 20 | 22.5 | 22.5 | 22.5 | 25 | 27.5 | 35 | 45 |
| Highway fuel economy [mpg] | 65.4 | 49.0 | 42.0 | 41.0 | 38.9 | 40.7 | 37.6 | 27.7 | ? |

1. Which of the following graphs is a **scatter plot** of the above data with car weight on the x-axis and fuel economy on the y-axis?
2. 
3. 
4. 
5. 
6. Which of the following equations represents the **equation of a line** through this data, based on using the two ordered pairs **(20, 49.0)** and **(35, 27.7)**?.
7. y = -0.704x + 63.1 where y = Fuel economy and x = Car weight
8. y = 0.704x + 34.9 where y = Fuel economy and x = Car weight
9. y = 1.42x + 20.6 where y = Fuel economy and x = Car weight
10. y = -1.42x + 77.4 where y = Fuel economy and x = Car weight \*
11. Based on more than 40 years of data, DeAngelo has derived the following equation to explain the relationship between the number of years of coaching experience and the number of wins of NFL coaches:

where y = number of winning games and

x is the years of coaching experience.

What would you **predict** to be the number of winning games for a coach with 17 years of experience?

1. Approximately 139 games
2. Approximately 161 games
3. Approximately 190 games
4. None of the above \*
5. Explain how to test a function to determine if it is continuous at a point x = c. Explain both a visual test and describe the three conditions which must be satisfied for a function to be continuous at a point. Provide examples of a continuous function as well as a function with a discontinuity. For each example, provide both the equation and the graph.

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Scoring Summary**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Learning Expectation (CLE)** | **Check for Understanding (CFU)** | **CBA Item #’s** | **Number of Points Earned** | **Total Points Possible** | **Percentage** |
| 1.1 |  | 35 |  | 15 |  |
| 1.1 | 1.6 | 1,2,3,4 |  | 10 |  |
| 1.2 | 1.7 | 24,25,26,27,28 |  | 12.5 |  |
| 1.2 | 1.10 | 29 |  | 2.5 |  |
| 1.4 | 1.8 | 11,12,13 |  | 7.5 |  |
| 3.1 |  | 7,8,9 |  | 7.4 |  |
| 3.1 | 3.1 | 10 |  | 2.5 |  |
| 3.1 | 3.13 | 5,6 |  | 5 |  |
| 3.2 | 3.8 | 14,15,16 |  | 7.5 |  |
| 3.2 | 3.10 | 17,18,19,20 |  | 10 |  |
| 3.4 | 3.9 | 23 |  | 2.5 |  |
| 3.4 | 3.14 | 21, 22 |  | 5 |  |
| 3.7 |  | 30 |  | 2.5 |  |
| 3.7 | 3.18 | 31 |  | 2.5 |  |
| 5.1 |  | 32,33,34 |  | 7.5 |  |
| TOTAL: |  |  |  | 100 |  |